Lab 2

Preparations

❖ Units for Expressing Concentration:

1. Molarity (M):-

It is number of moles of solution per liter of solution

M= $\frac{number\ of\ solution}{V\ (Liter)}$ = $\frac{n}{V\ (\ L)}$

Where n= $\frac{Wt}{M.wt}$

OR n= $\frac{\text{.....}}{\text{.....}}$

M= $\frac{Wt}{M.wt} * \frac{1}{V(L)}$ Mole .L^{-1} OR

M= $\frac{Wt}{M.wt} * \frac{1000}{V(ml)}$ Mole .L^{-1}

EX. How many gram of $AgNO_3$ used to prepare 500ml of 0.125M solution M.Wt 169.9 g.mol^{-1} ?

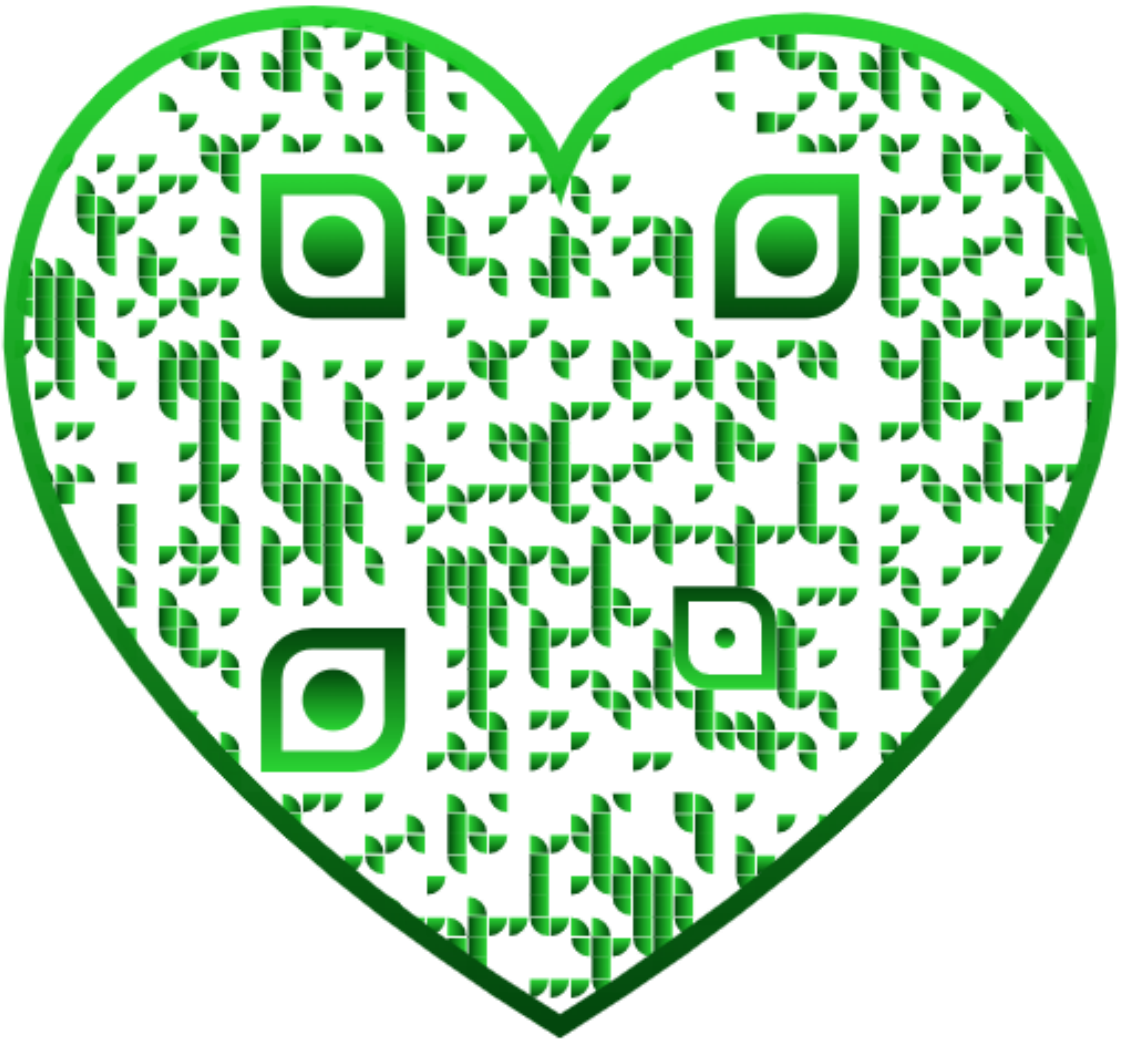
M= $\frac{Wt}{M.wt} * \frac{1000}{V(ml)}$ 0.125M = $\frac{Wt}{169.9\ \text{g.mol}-1} * \frac{1000}{500}$ $Wt =$

$\frac{0.125\text{M} * 69.9\ \text{g.mol}-1 * 500}{169.9\ \text{g.mol}-1}$ Wt= 10.61 gm

EX. Calculate the molarity (M) of solution result from dissolving 20 gm of sodium hydroxide in 2.0 Liter of solution (Na =23 , O = 16 , H = 1)

M= $\frac{Wt}{M.wt} * \frac{1}{V(L)}$ M.Wt = 23+16+1 = 40 g.$mole^{-1}$

M= $\frac{20\ \text{gm}}{40\ \text{g.mole}-1} * \frac{1}{2.0(L)}$ M = 0.25 Mole .L^{-1}



2. Normality (N):-

It is number of equivalents of solution

$$N=\frac{\text{number of solute equivalents}}{V\ (\text{liter})} \qquad N=\frac{\text{no of eq}}{V\ (L)}$$

Where no of eq == $\frac{Wt}{eq.wt}$

$$N=\frac{Wt}{eq.wt}*\frac{1}{V(L)}$$

OR

$$\frac{Wt}{eq.wt}*\frac{1000}{V(ml)}$$

EX. How many grams of sodium carbonate used to prepare 250ml of 0.20 N solution M.Wt =106 g.mol-1 ?

$$N=\frac{Wt}{eq.wt}*\frac{1000}{V(ml)}$$

Where eq.wt = $\frac{105}{2}$ = 53 g.eq-1

$$Wt=\frac{N*eq.wt*v}{1000} = \frac{0.20*53*250}{1000} = 2.65\ gm$$

EX. Calculate the normality (N) of solution result from dissolving 0.5 g of copper (II) hydroxide in 100ml of distilled water (Cu =63.5 , O =16 ,H=1)

$$N=\frac{Wt}{eq.wt}*\frac{1000}{V(ml)}$$

Where eq.wt = $\frac{97.5}{2}$ = 48.75 g.eq-1

$$N=\frac{0.5}{48.75}*\frac{1000}{100} = 0.103\ N$$

3. **Molality (m) :-** It is number of moles of solute per kilogram of solvent

$$m = \frac{\text{number of solute mloes}}{\text{wt.solvent (Kg)}}$$

$$m = \frac{wt}{M.wt} * \frac{1000}{\text{wt of solvent(g)}}$$

EX. Calculate the molality (m) of solution result from dissolving 5 g of sodium hydroxide in 250g of distilled water (M.wt = 40 g.mol-1)

$$m = \frac{wt}{M.wt} * \frac{1000}{\text{wt of solvent(g)}}$$

$$m = \frac{5}{40} * \frac{1000}{250}$$

m = 0.5 m

4. **Mole Fraction :-** It is the ration between the number of moles of solute OR solvent and to the total number of moles of solute and solvent

$X_1 = \frac{n1}{n1+n2}$ $X_2 = \frac{n2}{n1+n2}$ Note $X1 + X2 = 1$

EX. Calculate the mole fraction for A and B in their mixture if the moles of A =18 and B =40 moles

$$XA = \frac{nA}{nA+nB} = \frac{18}{18+40} = 0.310$$

$$XB = \frac{nB}{nA+nB} = \frac{40}{18+40} = 0.689$$

XA + XB 0.310 + 0.689 =0.99999= 1

5. **Percentages :**

a. **Weight to Volume percent ratio** :- It is the number of grams of solute in 100ml of solution

$$\% \ W/V = \frac{\text{Wt of solute}}{\text{V(ml) of solution}} * 100$$

b. **Volume Present ratio :-** It is the number of milliliter of solute in 100ml of solution

$$\% \ V/V = \frac{V(ml) \text{ solute}}{V(ml) \text{ of solution}} * 100$$

c. **Weight Present ratio :-** It is the number of grams of solute in 100 grams of solution

$$\% \ W/W = \frac{\text{Wt of solute}}{\text{Wt of solution}} * 100$$

EX. Calculate the percent ratio for solution result from dissolving 5 g of Sodium Hydroxide in 0.25L of distilled water

$$\% \ W/V = \frac{\text{Wt of solute}}{V(ml) \text{ of solution}} * 100$$

$$\% \ W/V = \frac{5}{250} * 100 = 2 \%$$